

July 21, 2006

Mr. Christopher M. Crane, President
and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BYRON STATION, UNIT NO. 1, AND BRAIDWOOD STATION, UNIT NO. 2 -
REQUESTED EXTENSION OF COMPLETION SCHEDULE FOR NRC
GENERIC LETTER 2004-02 "POTENTIAL IMPACT OF DEBRIS BLOCKAGE
ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT
PRESSURIZED WATER REACTORS" (TAC NOS. MC4669 AND MC4668)

Dear Mr. Crane:

By letter to the Nuclear Regulatory Commission (NRC) dated May 31, 2006, Exelon Generation Company, LLC (Exelon, the licensee) submitted a request for extension of the completion schedule for NRC Generic Letter (GL) 2004-02 "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors, for the Byron Station, Unit No. 1, and Braidwood Station, Unit No. 2. The completion schedule extension would affect downstream modifications to emergency core cooling system throttle valves and containment spray system pump cyclone separators. The NRC staff has reviewed Exelon's request for extension based on the mitigative measures to be in place prior to December 31, 2007, as well as any increased risk of extending the completion of the downstream modifications.

The NRC has concluded that Exelon has a plan that will result in the installation of final Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on PWR Sump Performance," modifications that provide acceptable strainer function with adequate margin for uncertainties. Exelon has put mitigation measures in place to adequately reduce risk for the requested short extension period, and it is therefore acceptable to extend the completion date for the corrective actions for the issues discussed in GL 2004-02 (specifically, the throttle valve modifications and the CS system pump cyclone separator replacements). The extension is until the completion of the Byron Station, Unit 1 and Braidwood Station, Unit 2 spring 2008 refueling outages, currently scheduled to begin approximately on April 30, 2008. Should Exelon elect to begin either refueling outage more than 30 days after April 30, 2008, Exelon will need to provide the NRC additional justification for further delay in completing corrective actions for GL 2004-02.

Sincerely,

/RA/

Robert F. Kuntz, Project Manager
Licensing Plant Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-454 and STN 50-457

Enclosure: Safety Evaluation

cc: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO REQUESTED EXTENSION OF
COMPLETION SCHEDULE FOR NRC GENERIC LETTER 2004-02
EXELON GENERATION COMPANY, LLC
BYRON STATION, UNIT NO. 1
BRAIDWOOD STATION, UNIT NO. 2
DOCKET NOS. STN 50-454 AND STN 50-457

In a May 31, 2006, supplemental response to Nuclear Regulatory Commission (NRC) Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors," Exelon Generation Company, LLC (Exelon, the licensee) described its activities for resolution of the Generic Safety Issue (GSI)-191 regarding containment sump clogging. Exelon stated that installation of new sump strainers in all four Byron and Braidwood units would be completed prior to December 31, 2007, with Byron Station, Unit 1 and Braidwood Station, Unit 2 scheduled for new strainer installation in their respective fall 2006 refueling outages. However, Exelon stated that both units are facing challenges to the installation schedule for certain modifications related to downstream effects, and therefore requested an extension to the GL 2004-02 completion schedule for downstream effects until the spring 2008 outages for both units (stated to be a 4-month duration extension request in Attachment 1, to the May 31, 2006, supplemental response).

In Attachment 1, to the May 31, 2006, supplemental response, Exelon summarized the GSI-191 issue analysis and testing status for the units, and explained that modifications related to downstream effects will be made to the emergency core cooling system (ECCS) throttle valves and the containment spray (CS) system pump cyclone separators. Exelon stated that it had conducted the downstream effects analyses called for in WCAP-16406, "Evaluation of Downstream Sump Debris Effects in Support of GSI-191."

Exelon explained that only eight ECCS throttle valves per unit had been identified as being susceptible to debris plugging, but Exelon plans to modify all 12 ECCS throttle valves in each unit to ensure potential plugging and hydraulic-related concerns are mitigated. The modifications will include replacement of trim and pressure-retaining parts and downstream orifices, for which the design finalization, procurement, shop testing, and installation schedule extend to the spring 2008 outages for Byron Station, Unit 1 and Braidwood Station, Unit 2. Exelon stated that the importance of comprehensively testing the new valve trim had been demonstrated through numerous operational experience events involving degradation of ECCS throttle valves through cavitation, citing NRC Information Notice 97-76, "Degraded Throttle Valves in Emergency Core Cooling System resulting from Cavitation-Induced Erosion During a Loss-of-Coolant Accident [LOCA]."

ENCLOSURE

Exelon elaborated on the need for proper setup and testing of ECCS throttle valves prior to installation in the reactor plants. Exelon also provided its schedule through January 2007 for procurement of parts for testing, the testing itself, and the procurement of throttle valve components for installation. The licensee stated that the schedule provided sufficient time to incorporate any lessons learned from the shop testing into the final design of the throttle valve trim parts, which would result in the lowest risk for adverse impact upon the ECCS system.

Exelon stated that it is evaluating the replacement of the CS pump cyclone separators with a pressure breakdown device. Upon finalization of the design, parts will be procured and installation will be planned for the Byron Station, Unit 1 and Braidwood Station, Unit 2 spring 2008 refueling outages.

Exelon stated that mitigative measures will be in place prior to December 31, 2007, at Byron Station, Unit 1 and Braidwood Station, Unit 2 as follows:

- Actions taken, in response to Bulletin 2003-01 "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," regarding foreign material exclusion from containment and loose debris surveillances, and training and procedural guidance to expedite plant cooldown in response to a small-break LOCA;
- The absence of calcium silicate insulation and trisodium phosphate buffer;
- The almost exclusive use of reflective metal insulation (RMI) inside containment;
- The applicability of the reactor coolant primary piping leak-before-break principle; and
- The lack of credit for containment overpressure in the net positive suction head (NPSH) analysis for the CS system pumps and residual heat removal (RHR) pumps (leading to additional NPSH margin).

Exelon stated that additional mitigative measures to be taken during the fall 2006 refueling outages include:

- Installation of new replacement sump strainers in each of the two sumps in each unit (approximately 3,000 square feet/sump);
- A new mesh screen size of 1/12" versus the current 3/16";
- The installation of trash racks upstream of the new sump screens to intercept large debris;
- For Byron Station, Unit 1, the removal of fiberglass insulation in the mid-section of the steam generators and replacing it with RMI insulation; and
- The sizing of the replacement strainers being based on conservative debris quantities (e.g., the quantity of qualified coating debris being based on the 10 pipe diameter zone of influence [ZOI] that preliminary industry data indicates may be significantly conservative).

While stating that it is not possible to quantify the likelihood of debris being transported to and significantly plugging the throttle valves, Exelon provided a description of the location of throttle valves (in the discharge line from the safety injection (SI) pumps to the reactor coolant system (RCS) cold legs, in the discharge line from the SI pumps to the RCS hot legs, and in the discharge line from the chemical and volume control system (CVCS) pumps to the RCS cold legs, but not in the RHR pump discharges), and provided a risk impact evaluation which listed a number of factors making the likelihood of plugged throttle valves very low:

- While the LOCAs most likely to transport debris to the ECCS sumps are large ones (with large ZOIs) and those in which the CS system is actuated (providing additional generation and transport for debris), the only LOCAs requiring CVCS charging pumps and SI pumps to operate and provide core cooling while in recirculation from the ECCS sump are LOCAs from smaller break sizes;
- LOCAs resulting from a break in a line larger than 3" in diameter will depressurize the RCS and result in RHR flow rather than CVCS and SI pump operation;
- LOCAs resulting from a break in a line 3" in diameter or smaller would be extremely unlikely to dislodge and transport sufficient debris to the ECCS system to plug throttle valves;
- LOCAs resulting from a break in a line 3" in diameter or smaller will likely not pressurize the containment sufficiently to actuate the CS system unless all four reactor containment fan coolers fail, so that ECCS flow from the CVCS and SI pumps in recirculation mode would be relatively low;
- For LOCAs that are 3" in diameter or smaller, there is an increased probability that operators will successfully cooldown and depressurize the RCS prior to the need for high-head ECCS recirculation; and
- Thermal-hydraulic sensitivity studies on the most limiting 3" line break LOCA scenario showed that even if operators fail to cooldown and depressurize the RCS, and throttle valves were assumed to be sufficiently plugged to reduce the cold-leg injection flow from one CVCS or SI pump by 50 percent, adequate core cooling would be provided in the ECCS recirculation mode.

Exelon stated that it had concluded that only a narrow set of circumstances have the potential to increase the risk of core damage during the requested 4-month extension period and that there would be only a very small incremental risk increase.

Exelon provided a separate risk impact evaluation for the CS system pump cyclone separators. Exelon stated that the design function of the CS system is to remove iodine from the containment atmosphere, performing this function following larger LOCAs when containment pressure reaches 20 pounds per square inch gauge, reducing the post-accident source term to the environment as well as reducing containment pressure. The CS system is not credited in the probabilistic risk assessment because it provides no heat removal from containment during recirculation, and is therefore not important in preventing core damage or large early release. Therefore, plugging of the CS system pump cyclone separators would not impact core damage

frequency or large early release frequency. While CS is potentially important for delaying and/or reducing the severity of late releases, Exelon expects this impact to be very small due to the low likelihood of a core damage event requiring CS.

The NRC has confidence that Exelon has a plan that will result in the installation of final GSI-191 modifications that provide acceptable strainer function with adequate margin for uncertainties. Further, the NRC has concluded that Exelon has put mitigation measures in place to adequately reduce risk for the requested short extension period, and it is therefore acceptable to extend the completion date for the corrective actions for the issues discussed in GL 2004-02 (specifically, the throttle valve modifications and the CS system pump cyclone separator replacements) until the completion of the Byron Station, Unit 1 and Braidwood Station, Unit 2 spring 2008 refueling outages, currently scheduled to begin approximately on April 30, 2008. Should Exelon elect to begin either refueling outage more than 30 days after April 30, 2008, Exelon will need to provide the NRC additional justification for further delay in completing corrective actions for GL 2004-02.

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Date: July 21, 2006

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